MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/2022

BEM1034 – MATHEMATICS FOR ECONOMICS

(All sections / Groups)

09 AUGUST 2022
9.00 a.m – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **5 pages** including cover page and Mathematical formulas with **4 Questions** only.

2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.

3. Mathematical formulas are provided at the end of the paper.

4. The candidate is allowed to use scientific calculators that are permitted to be used in the examination.

Question 1 (25 marks)

a) Given the usual sample space $S = \{1, 2, 3, 4, 5, 6\}$ for the rolling of a die. Let E, F and G be the events

$$E = \{1, 3, 5\} \qquad F = \{3, 4, 5, 6\} \qquad G = \{1\}$$

Determine each of the following event.

i) E'

[2 marks]

ii) $E \cup F$

[2 marks]

iii) $E' - F$

[3 marks]

iv) $F \cap G'$

[3 marks]

b) Solve the following equation.

i) $\log_x(2x-3) = 1$

[2 marks]

ii) $\log 7 - \log(x-1) = \log 4$

[3 marks]

c) The cost for a firm producing q units of a product is given by the cost equation

$$c(q) = (5q \ln q) + 15$$

Evaluate the cost when $q = 12$. (*Round your answer to two decimal places.*)

[5 marks]

d) The projected population of a city is given by $P = 125000(1.11)^{t/20}$, where t is the number of years after 1995. What is the projected population in 2022?

[5 marks]

Continued...

Question 2 (25 marks)

Given the technology matrix **A**,

$$\mathbf{A} = \begin{array}{c} \\ \text{P} \\ \text{Q} \\ \text{R} \end{array} \begin{array}{c} \begin{array}{ccc} \text{P} & \text{Q} & \text{R} \end{array} \\ \begin{bmatrix} 0.2 & 0.3 & 0.2 \\ 0.4 & 0.1 & 0.3 \\ 0.3 & 0.5 & 0.2 \end{bmatrix} \end{array}$$

Final demand for industries is given by vector **D**,

$$\mathbf{D} = \begin{bmatrix} 150 \\ 200 \\ 210 \end{bmatrix}$$

By applying $\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{D}$ formula, determine the total demand, **X**, for industries P, Q and R. (*Round your answer to two decimal places.*)

[25 marks]

Question 3 (25 marks)

a) Evaluate the following limits.

i) $\lim_{x \to 1} \dfrac{x^3 - 1}{x - 1}$

[3 marks]

ii) $\lim_{x \to 6} \dfrac{\sqrt{x-2} - 2}{x - 6}$

[3 marks]

b) Differentiate the following functions:

i) $y = \dfrac{\left(x^4 + 4x\right)^3}{\left(4x^2 - 9\right)^5}$

[6 marks]

ii) $f(k) = e^{2k} \ln(k + 2)$

[4 marks]

Continued...

c) By using Jacobian dominant, test the functional dependence of the following functions and state your findings.

$$y_1 = 3x_1 - 4x_2$$
$$y_2 = 9x_1^2 - 24x_1x_2 + 16x_2^2$$

[9 marks]

Question 4 (25 marks)

a) Find each of the following:

i) $\int \frac{\ln x}{\sqrt{x}} dx$

[5 marks]

ii) $\int_{-1}^{2} xe^{x^2} dx$

[6 marks]

b) State the order and degree of the following differential equations.

i) $xy''' + y'' + \cos(x)y = \sin(x)$

[2 marks]

ii) $\left(\frac{d^2y}{dx^2}\right)^7 = \sqrt{1+\left(\frac{dy}{dx}\right)^2}$

[2 marks]

c) Solve the following differential equation using separable equation method.

$$y' = 2xe^{x^2-\ln(y^2)}$$

[10 marks]

End of Question.

Summary of Formulas

1. **Input – Output Model**

$$(I-A)X=D$$

Where A is the input-output matrix, D is the external or final demand and X is the production level.

2. **Total differential (Change)**

If $z=f(x,y)$, then the total change is $dz=f_x dx+f_y dy$

3. **Elasticity of Demand**

$$\varepsilon_d=-\frac{dq}{dp}\bigg|_{(q,p)}\bullet\frac{p}{q}$$

4. **Consumers' Surplus (CS)**

$$CS=\int_0^{\bar{q}} D(q)dq-\overline{pq}$$

Where $\bar{p}$ is the unit market price, $\bar{x}$ is the quantity sold and D is the demand function.

5. **Basic Rules of Differentiation**

i) Chain rule: Derive $g[f(x)]=g'[f(x)]f'(x)$

ii) General power rule: Derive $[f(x)]^n=n[f(x)]^{n-1}f'(x)$

iii) Exponential function: Derive $e^x=e^x$

iv) Derive $(e^u)=e^u[u'(x)]$ Logarithmic function: Derive $\ln x=\frac{1}{x}$

Derive $(\ln u(x))=\left(\frac{1}{u(x)}\right)[u'(x)]$

6. **Basic Rules of Integration**

i) Exponential function: $\int e^u du=e^u+C$

ii) Logarithmic function: $\int\left(\frac{1}{u}\right)du=\ln u+C$

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